"NEW YORK ELECTRICAL SHOW" IN THIS NUMBER

THE ELECTRICAL EXPERIMENTER

DEC. 1914

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CONTENTS

Columbia University Radio Laboratory.

The New York Electrical Show.

A 40 Kilowatt Electro-Magnet.

Lesson II. on Electro-Plating.

An Efficient Galena Detector.

A New Wireless Break-In System.

How to Make a Miniature High Frequency Outfit.

Vol. 2
No. 8

"The Experimenter's Magazine"

H. GERNSBACK, Editor H. WINFIELD SECOR, Associate Editor

THE ELECTRICAL EXPERIMENTER

VOL. II DECEMBER, 1914 NUMBER 8

The Radio Laboratory at Columbia University

COLUMBIA UNIVERSITY, located at New York City, has an extensive Radio Research Laboratory, which is equipped with some of the very latest wireless apparatus available, such as, radio frequency alternators, special receiving amplifers, extra sensitive measuring instruments, etc.

At the left is the extremely large "lead-in" insulator.

Below is seen a part of the "antenna" at Columbia.

The aerial is a large affair and as our illustration shows, it is of the inverted "L" type, extending 550 feet between spreaders, and elevated 125 feet above the ground. It comprises four strands of phosphor bronze stranded cable spaced five feet apart on sixteen foot spreaders, which are trussed from the ends to the center to give greater strength against bending. The lead-in of stranded cable also is about 300 feet long and the whole aerial system has a natural period of approximately 1,650 meters. It extends clear across the University grounds, and is supported from two steel masts each about fifty-five feet long, which are mounted on the roofs of Havemeyer Hall and Schermerhorn Hall, respectively. The aerial strands have two large ribbed electrose insulators placed in tandem at each end, and the lead-in wire is likewise guyed in position. The aerial is kept from swaying or turning on its axis partially by two guy wires fastened to either end of the spreader, and led down to the roof supporting the mast.

The Radio Laboratory and station is located in the basement of Philosophy Hall, and the lead-in is brought in thru an extra heavy insulating tube, the appearance of which our photo shows. The equipment includes among other things, a Marconi 2 K. W. quenched set of latest pattern, arranged for sending messages on the outdoor aerial or for test work on a phantom indoor aerial. Also here is located a General Electric Co. (Alexanderson type) high-frequency alternating current generator. It is of the inductor type, and the moving element rotates at 20,000 revolutions per minute at normal loads; the alternator delivering 100 volts and up to ten amperes, or one K.V.A. The machine normally produces a frequency of 200,000 cycles per second. It is driven by a motor and speed change gear having a ratio of ten to one. This machine is used for special research work.

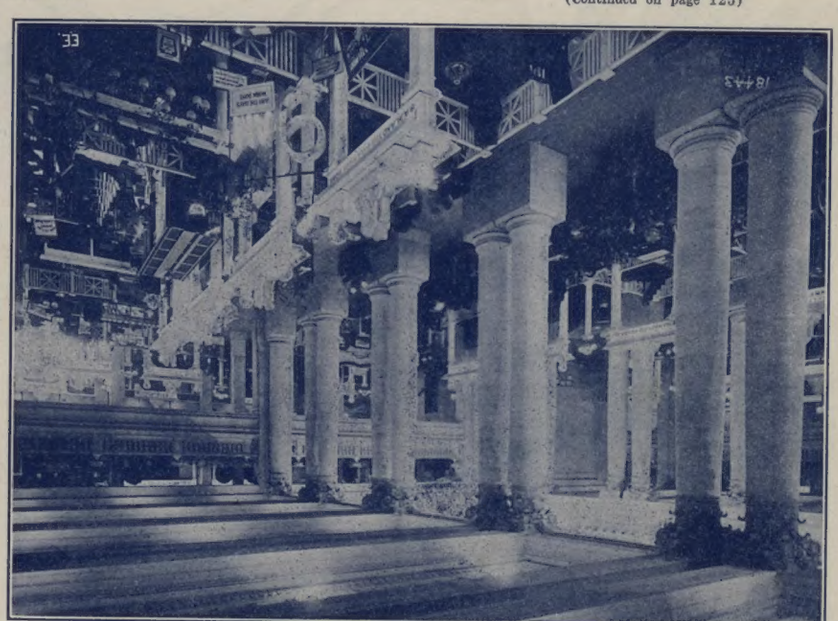
This information is available, thanks to the courtesy of Prof. J. H. Morecroft, who has charge of the radio work at Columbia.

THE NEW YORK ELECTRICAL SHOW.

Jules Verne would have had an awakening had he been at the eighth annual electrical and motor show in Grand Central Palace, New York, held from October 7th to the 17th. He would have seen that the wildest dreams are not beyond realization when once the electrical engineer gets hold of them. Without a doubt he would have taken three or four looks at the "electric cows" and the rapid fire cheese factories on the third floor of the palace.

The United States government and the State of New York installed half a dozen educational exhibits. Twelve processes in the making of coins, including the melting, pouring, cleaning, sheering, rolling, punching, milling, annealing, washing, drying, coining and testing processes, were shown. The United States army exhibit included arsenal machinery for the making of ordinary rifle cartridges; also a full equipment of telephone and signaling apparatus used by the signal corps. The United States navy provided

(Continued on page 125)



The beautiful lighting effect obtained at the recent Electrical Show in New York City. (Photo courtesy, New York Edison Co.)

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All communications and contributions to this journal must be addressed to: Editor, "The Electrical Experimenter," 233 Fulton Street, New York. We cannot return unaccepted contributions unless full return postage has been included. ALL accepted contributions are paid for on publication. A special rate is paid for novel experiments; good photographs accompanying them are highly desirable.

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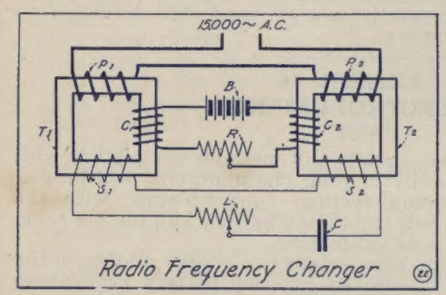
INSTITUTE OF RADIO ENGINEERS' MEETING.

The regular monthly meeting of the Institute of Radio Engineers was held at Columbia University, New York City, October 7th, and Dr. Alfred Norton Goldsmith, who had just returned from war-ridden Europe, gave a lecture on "Radio Frequency Changers." His talk dealt with the old, as well as the newer frequency charging devices and schemes, including the Goldsmith alternator and the latest non-revolving frequency changing device being applied by the Telefunken Company. The latter arrangement, as seen in Europe by Dr. Goldsmith, worked wonderfully well and also efficiently. By this stationary machine, it is possible to produce a triple frequency in comparison to the basic exciting frequency, which in practice is made about 12,000 to 15,000 cycles per second. Hence the triple frequency transformer would raise the exciting value of say 15,000 cycles to a value of 45,000 cycles. These values and much higher have been obtained in practice and so for radio-telephonic purposes, the matter of frequency is solved nicely. Also by the delicate balance obtaining between the various tuned transformer circuits, it is readily possible to control the full antenna current by a microphone carrying only a small current and connected in but one of these tuning or frequency control circuits or in the D. C. circuit shown in the diagram. This is in line with the well known trigger control of alternators principle much in vogue in this country. To give some idea of the Telefunken Frequency changing method, the diagram here shown may be referred to. Here two closed core transformers T 1 and T 2 are indicated, having a primary and secondary coil on each, which are oppositely wound with regard to one another. Two D. C. magnetizing coils C 1 and C 2 are also wound on the transformer cores, and the two secondary coils S 1 and S 2 are hooked in series to a tuning inductance and a condenser C. The D. C. circuit is supplied by a battery, for instance at B, controlled by a rheostat R. Due to a peculiar action of the single phase exciting A. C. in the primary coils, on the magnetization created by the D. C. coils, the sinusoidal wave form of the primary A. C. is greatly flattened or distorted, and it results finally thru the reflection of the magnetizing forces on one another that a double and even a triple frequency is produced. The inductance L and the capacity C, help to tune the secondary circuits to feature the predominating frequency harmonic wanted. Some remarkable work has been done in Germany along these lines, Dr. Goldsmith stated, and this arrangement is supposed to be as efficient as the Goldsmith machine. The published proceedings of the institute are procurable from the Secretary, Emil J. Simon, 71 Broadway, New York City.



Arrangement of static transformer circuits for producing triple frequency multiplication.

THE ELECTRICAL BARBER.

If tradition is to be credited, barber shop conversation has from the first been somewhat one-sided. To-day it is bound to be. The electric vibrator leaves no alternative.

Within the last three years this with other electric tonsorial appliances has not only entered the field but taken possession. Time was, in a less enlightened age, when a shave was sufficient. To-day the features thus treated must be massaged. Once, a haircut met all requirements. Nowadays the head must also be vibrated—to the benefit, presumably, both of the member in general and the operator in particular. Again, and not so long since, a vigorous toweling and fanning were the accepted corollaries of a shampoo. The modern recipe calls imperatively for the electric dryer.

To return to the vibrator. The outfit de luxe which every barber either possesses or aspires to, is wound to operate on any lighting circuit and is accompanied by a liberal assortment of rubber tips or "applicators." The device is equipped with an air-cooled motor while a lever regulates the stroke, soft or penetrating, strong or light, as desired. The machines give from ten to thirty thousand vibrations a minute. Such is the construction that there is absolutely no vibration in the handle.

Fig. 1. The Barber Shop "De Luxe" where patrons may have their facial muscles and skin rejuvenated by electrical massage.

Fig. 2. The up-to-date Barber dries your hair quickly by a hot or cold draft from an electric blower.

The electric hair dryer to which the hurried customer finds himself lastingly obligated is perfectly able to accomplish its mission in a minute or even less. As the reader is doubtless well aware, he has the option under the circumstances of demanding either hot or cold air. The tube is of telescopic pattern and adjusted to from fourteen to twenty-four inches in length.

The motor employed in these dryers is ingenious. It rests on a ball-bearing constructed pedestal and is swivel mounted, an arrangement that permits of the air current being turned in any direction at will by a mere touch of the hand. A disc is found on the side of the dryer to regulate the temperature along with a three-point indicator switch for cold air, hot air, or the stopping of the apparatus.

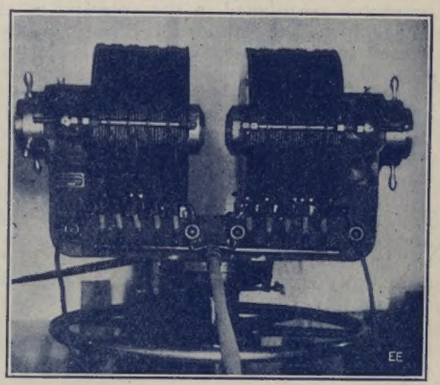
Although rumors are abroad concerning the very recent appearance not only of an electric brush, but an electric comb, the progressive shop, if equipped as per above, may in all conscience content itself.

—(*Edison Monthly.*)

A POWERFUL FRENCH MAGNET.

By Frank C. Perkins.

At the Laboratoire de Physique of the Museum National D'Histoire Naturelle in Paris there is a powerful electric magnet, as seen in the accompanying illustration designed by Prof. Jean Becquerel.



A 40 Kilowatt experimental electro-magnet with water cooled coils.

It has a diameter of 1.75 meters and is provided with two coils, each having five sections and each section wound with 500 turns, making a total of 5,000 turns of wire. It will be noted that this high power electric magnet has a water cooling system with ten tubes in parallel conducting water for cooling each of the ten sections, the water being used under a pressure of thirty to thirty-five meters. This French electro-magnet is used with a current of 250 amperes and 160 volts.

These powerful electro-magnets are very useful in the study of the finer particles of matter; such as ions, etc.

Christian E. Arthurs of New Rochelle, N. Y.:

"I am a constant reader of the Electrical Experimenter and could never be without it. I will shortly send you fifty cents for a year's subscription."

Experimental Electricity Course

By S. Gernsback and H. Winfield Secor

LESSON 15.
ELECTROPLATING.
PART I—(Continued).

For plating articles with nickel not over 6 volts is generally used. To supply the current which must be steady, 2 to 4 Gordon primary cells may be used, also Crowfoot, Bunsen or Daniell cells are adaptable. Storage cells form an excellent source of current supply. The type "S S" 6 volt, 4 ampere dynamo shown at Fig. 5, can also be employed if desired. A water wheel can be utilized to drive it with. The water wheel also would be very useful for driving the polishing head, containing the buffing wheel. A water motor delivering ⅛ to ½ horse-power, depending upon the size and pressure of the water main feeding it, is shown by the cut Fig. 8.

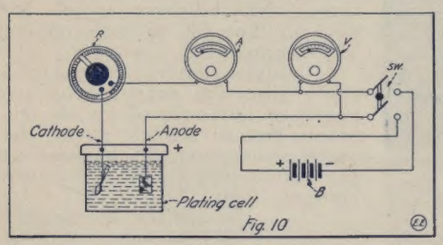


Fig. 10

It is advisable to measure the voltage and amperage of the plating, current for any serious work, and the instruments appearing in Fig. 9 are admirably suited to this work. The arrangement of a complete plating plant, with battery or dynamo B, rheostat R, ammeter A, voltmeter V, and main switch SW, are shown in the diagram Fig. 10.

In the glass plating tank, shown at Fig. 7, two nickel grids or plates are placed in the solution at either side of the tank. These form the "anodes" or positive electrodes, and are connected to the positive pole of the plating circuit, as seen from Fig. 10 diagram. The binding post attached to the centre rod of the frame is connected to the negative side of the feeding circuit, and forms the "cathode" of the tank, when the articles to be plated are connected to it and immersed in the solution. Small copper wires (18-24) may be used to swing the objects from the centre or cathode rod.

Much importance attaches to the manner of suspending the articles to be plated in the tank. If the article is nearer one anode plate than the other, then the side nearest it will receive the heaviest deposit, and vice versa. The object must be spaced as equally distant as possible, from both anode plates, and in this matter, the shape of the object has much to do with determining just how it shall be suspended. A little experience and reasoning will soon teach the experimenter the best way in which to arrange a certain article to receive the most even deposit.

The solution filling the plating tank is made up of the nickel salts dissolved into 35 ounces (the capacity of the tank) of warm water. The mixture is stirred well with a wooden stick until all the salts have been dissolved, when the plating tank is filled with the solution. The following are formulas for nickel plating baths with sulphate as the base:

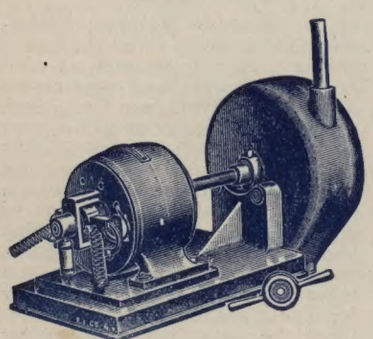


Fig. 11. Water motor direct connected to dynamo.

	—Parts—	
Ammonium and nickel sulphate..	4	1
Distilled water....	100	10
Ammonium carbonate (about)..	3	

The double sulphate, as given above, is widely used for nickel plating. The chloride may also be employed as a basis for nickel plating, as per the following formula.

	Parts.
Nickel chloride	298
Water	2,250
Dissolve and add:	
Ammonium chloride	70
Water enough to make	10,000

The addition of boric acid to nickel plating solutions is recommended by Edward Weston in the following proportion: Two parts of boric acid to five parts of nickel chloride or one part of boric acid to three parts of nickel sulphate.

Too much alkali in a nickel bath results in a yellow deposit. Too much acid gives a non-adherent coat. The bath must be perfectly neutral. It should have a specific gravity of 1.041 to 1.056, as measured by a hydrometer. If it is weaker, the bath works slowly; if stronger than specific gravity 1.070, the salts crystallize on the anodes. The bath should be constantly watched for changes in its density or specific gravity.

Articles to be nickel plated are very thoroughly scoured and cleaned, using a stiff scouring brush and pumice powder, having first dipped the articles into boiling caustic soda solution for ten to fifteen minutes. When well cleaned, as above described, a fine copper wire is attached, and the object, if of iron or steel, should be dipped in a bath composed of ½-lb. hydrochloric acid per one gallon water, using a wooden tank to hold the solution. If the article is of brass or copper, they should be dipped in a bath of ½-lb. cyanide of potassium per one gallon of water. About two hours' immersion in the plating cell here mentioned will give a good deposit, causing it to peel off. Iron or steel should receive a copper plate deposit first, as a base for nickel or other plate to make a first class job. Further details are given in the next chapter, No. 16. At Fig. 11, is illustrated a complete hydroelectric plant, comprising a water motor and D. C. dynamo on one bed-plate. This set on 50 to 70 lbs. water pressure from a ¾" main will develop 7 to 8 volts and 8 to 10 amperes.

LESSON 16.
ELECTROPLATING.
PART II.

In this chapter further details and methods for plating with various metals such as silver, gold, platinum, etc., will be discussed. In the foregoing section, copper-plating with the "Electro" self-exciting cell combining battery and plating tank, was covered, as well as nickel-plating.

A few words are added here, relative to copper plating in the regular manner, that is, with an external battery or dynamo current feeding the plating vat. The best potentials or voltages for different metal depositions are tabulated herein.

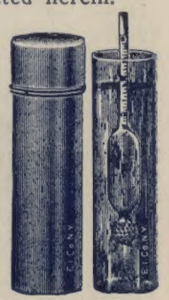


Fig. 1. A Hydrometer

For a copper plating bath to be used for objects not attacked by sulphuric acid or copper sulphate, a good make-up is a solution of copper sulphate, with one-tenth of its volume of sulphuric acid. The specific gravity as measured by a hydrometer, (see Fig. 1), should be 1.197, and the bath cold when used. If too much copper sulphate is in the bath, crystals will form on the surface of the anode, or positive electrode. These crystals, altho quite invisible, will prevent the current from passing. The bath here mentioned is quite limited in use, as it is not permissable for plating iron or zinc, etc. It can be employed for wax moulds, such as those utilized for electrotyping. The exact formula for the above copper-acid solution is: Sulphate of copper, 1 lb.; sulphuric acid, 1 lb.; water, 1 gal. The sulphate of copper is first dissolved in hot water, when the remainder of the water may be added cold. Then the sulphuric acid is placed into the solution, allowing the mixture to cool well before using.

For plating copper on zinc, iron, etc., the solution should be the copper-cyanide mixture, the proportions being as given here: Carbonate of potash, 6½ ozs.; cyanide of potassium, 2 lbs.; water, 3 gals. The cyanide of potassium is dissolved in the major portion of the water, and the carbonate of copper in a portion of it, with the carbonate of potash in still another portion; add to the potassium solution, first the copper solution and then the potash solution, thoroly stirring the whole. If the solution, on trying out, does not deposit freely, a little more cyanide or more carbonate, or both, may be added until the right effect is obtained.

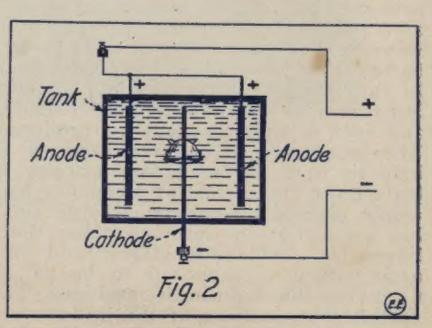


Fig. 2

In plating copper on zinc, the zinc object is first dipped into a mixture of 4.5 per cent. sulphuric acid, and after rinsing well in water, it is dipped into a solution of caustic soda or sodium

carbonate, after which it is ready for the plating tank. One principal use for copper plate on iron is for a base on which to deposit a silver, gold or nickel layer. This gives the most durable finish, with a smooth even coat.

For copper plating, the plates forming the anodes or positive electrodes are copper grids of as pure a quality as possible. In Fig. 2 is shown the method of arranging the copper anodes and articles to be plated in the bath, the sketch being a view from the top of the plating tank.

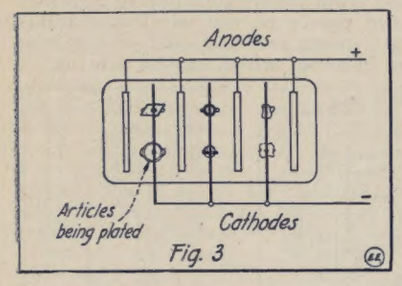


Fig. 3

Below is given a table of the usual potentials employed for various kinds of electro-plating. The voltage should be specially adjusted for each case to give the most suitable current, and depends upon the size of the plating tank, the area of the anodes, the strength of the solution, and several other things, and most platers determine the best potential and current for a certain purpose by experiment.

Metal.*	Approx. Volts Potential
Copper—cyanide bath	.5 to 1.5
Copper—acid bath	3.0 to 5.0
Silver	.5 to 1.0
Gold	.5 to 4.0
Brass	3.0 to 5.0
Iron, steel facing	1.0 to 1.3
Nickel on iron, steel, copper, with nickel anodes; start deposit at 5 volts, diminishing to	1.5 to 2.0
Nickel on iron, steel, copper, with carbon anode	4.0 to 7.0
Nickel on zinc	4.0 to 7.0
Platjnum	5.0 to 6.0

*Electrical Engineer's Handbook, International Textbook Co.

For certain purposes, such as wireless telegraph condensers, etc., it is often desirable to deposit a copper coating on glass. For the very best work, the copper or sometimes silver should be burnt into the glass to minimize blistering under heavy charging. However, copper plating in the ordinary way is far superior to the common method of pasting tinfoil on the glass, as there is bound to be air spaces left between the foil and the glass, and at these points, the weak spots develop, until finally the glass plate or jar fails and is punctured by the high voltage.

The following scheme of depositing a metal plating on glass plates or jars is described by S. Wein in Modern Electrics for August, 1912.

Prepare a mixture of sulphur and oil of spike, (Lavendula spika), having it of the consistency of molasses; also a saturated solution of chloride of gold in sulphuric ether. Mix the two and evaporate at a gentle heat to the consistency of paint. After thoroly cleaning the glass surface, paint a thin coating of this mixture on the surface to be plated, and bake in an oven or furnace, to drive off the sulphur and other volatile ingredients. The result is a very thin metallic film which strongly adheres to the glass surface, which film may be reinforced by electroplating with copper in the ordinary manner. This makes a very suitable coating for Leyden jars, and the like.

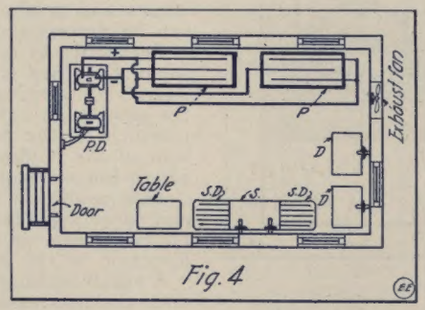


Fig. 4

A somewhat simpler method is to roughen the surface of the glass by means of applying hydro-fluoric acid, sand blasting under air pressure, or grinding with emery or carborundum dust. The surface after being evenly roughened is painted with a saturated solution of silver nitrate. After this has dried, the treated surface should be electroplated with copper.

Still another scheme differs from the foregoing, only that in painting the roughened surface of the glass, the painting medium is a very thin film of prepared Acheson graphite, instead of the silver nitrate solution.

Silver plating is an important branch of electro-plating. Articles which are to be silver plated must be carefully prepared, and should be very smooth on the surface.

The article is first boiled in a 10 per cent. solution of caustic potash to cut all oil, grease and dirt from the surface. After boiling, the object is rinsed in cold water and then dipped in a 10 per cent. solution of sulphuric acid and water, and then washed. Next they are passed thro a bath composed of: Nitric acid (36°), 100 parts; salt, (sodium chloride), 2 parts; calcined lampblack, 2 parts. After a few seconds they are thoroughly washed and then immersed in the following bath: Nitric acid (36°), 600 parts; sulphuric acid (66°), 80 parts; salt, (sodium chloride), 4 parts.

After emerging from this treatment, they are well washed and cleansed, when they are dipped in the following quickening bath, until the objects appear white on the surface: Water, 100 parts; Mercuric nitrate, 1 part; with sufficient sulphuric acid to dissolve the mercuric nitrate. The pieces are then washed and placed in the plating bath.

The common solution for silver plating is the potassium-silver-cyanide mixture. A solution of silver nitrate in water is precipitated by the addition of lime water, the silver oxide appearing as a brown powder. The precipitate is washed carefully, and is kept in vessels filled with water. To prepare a bath for the plating tank a quantity of the brown oxide of silver is dissolved in a solution of potassium cyanide in distilled water.

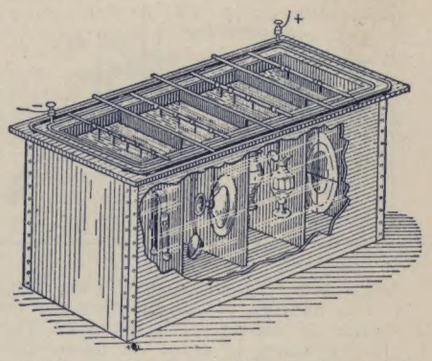


Fig. 5. How Various Articles Are Suspended in Plating Tank

Iron or lead wire, not copper, must be used to suspend the articles in the bath. At least 4 inches of space must be left between the silver anode grid and the object to be plated. When the pieces have acquired a sufficiently heavy coating of silver, they are removed from the bath, washed in cold water, and then with slightly acidulated water, using a little sulphuric acid in the water, the silver plated articles are finally brushed and polished by the regular process.

Gold plating is accomplished by using a tank bath of gold-potassium cyanide: 154 parts of gold chloride being dissolved in 2000 parts of pure water. A separate solution of 200 parts of potassium cyanide in 8000 parts of water is made. Then the two solutions are mixed and boiled for half an hour. The bath is used cold. To maintain its strength, gold chloride and potassium cyanide may be added in equal parts as required.

For gilding with a warm solution the following baths may be used:

	(1)	(2)
Sodium phosphate (crystallized)	600 parts	500 parts
Sodium bisulphite	100 parts	125 parts
Potassium cyanide	10 parts	5 parts
Gold chloride	12 parts	12 parts

The first (1) is for gold plating silver, copper and alloys rich in copper. The second (2) is for iron and steel.

The anode for gold plating is a grid or plate of gold. If the bath is too rich in gold, it causes the coating deposited to be black or red in appearance. If the coating is gray, and forms slowly, it indicates too much potassium cyanide. The suspension wires holding the anode, etc., are of platinum.

The plating of platinum on various objects is often required for electrical apparatus, etc. The following bath is suitable for platinum deposits on copper and its alloys: Dissolve 17 parts of platinic chloride in 500 parts distilled water. Then dissolve 100 parts ammonium phosphate in 500 parts of distilled water. The solutions are now mixed, giving a precipitate. Slowly, a solution of 500 parts sodium phosphate in 1000 parts water, is added, and the whole brought to boiling; replacing the water lost by evaporation, until the ammonia having been boiled away, the solution becomes acid and loses the yellow color it formerly possessed, and becomes colorless. This bath is employed while hot, and its strength is maintained by adding ammonium-platinum phosphate precipitate as obtained above. The anode plate in platinum plating is always platinum.

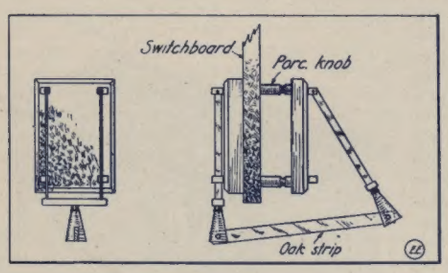
Sometimes it is desired to brass plate certain articles, such as small castings, or parts of models or apparatus when the metal is of some other material. A brass solution is easily made out of the copper cyanide bath cited above, by adding zinc carbonate solution. This is prepared by dissolving 2 parts by weight, of cyanide of potassium and 1 part of zinc carbonate in water. The zinc carbonate solution is added to the copper cyanide bath until the desired color of brass deposit is obtained. The anode is of sheet brass.

(To be continued)

A QUICK THROW AERIAL SWITCH.

Having two large sixty ampere D. P. S. T. switches with which I wished to make an aerial switch of the quick throw type, and being cramped for room on my switch board, I arranged the switches as follows:

The switch to be used for the receiving switch was fastened on the board so that the handle projected below the bottom of the board. The other switch was on porcelain insulators on the back of the board, directly in back of the other, or, if the switch board is not of very heavy material, about one-half inch below the other so that the screws, which hold them to the board, will not touch each other.



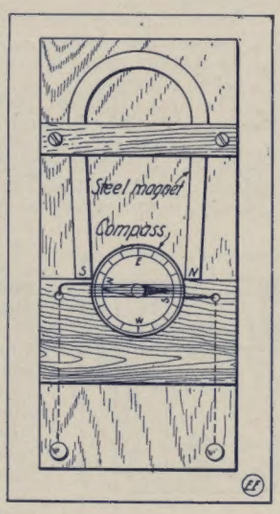
The handles of the switches are then removed, slotted and drilled as shown in the sketch. The piece, used to connect the switches, is made of three-eighth inch oak or similar hard wood, and is just long enough so that the blades of one switch make an angle of about thirty degrees with those of the other switch. Holes are drilled in the ends of the piece, and bolts run thru the holes in the handles and the stick.

The operation of this switch is very quick and simple and the insulation much better than that on most aerial switches heretofore described in various publications.

Contributed by FRANK H. BROOME.

A SIMPLE GALVANOMETER.

Many experimenters would, I have no doubt, like to know how to make a small galvanometer. The following is a description of one that I made and found quite handy. Use the E. I. Co. No. 1325 Compass which can be purchased for a few cents; also a Magnet which can be taken from an old telephone magneto or bought of the E. I. Co. Fasten the magnet to a base by a short wooden strip laid across the magnet legs and held in place by a wood screw. Wrap a few dozen turns of No. 30 B. & S. Gauge around the compass and leave about 4 inches at each end for making connections. Fit the compass between the poles of the magnet, and hold it in place by a wooden block cut to the size of the compass. Nail the block in place by a few brads. Next bore two holes, one on each side of the compass for the connecting wires. Fasten these wires to the binding posts in the end of the base. The current can be detected by only the compass but with the addition of the magnet the compass settles more quickly and will detect a very small current. Batteries can be tested with this instrument very nicely. For testing weak currents the steel magnet should not be left too close to the compass.

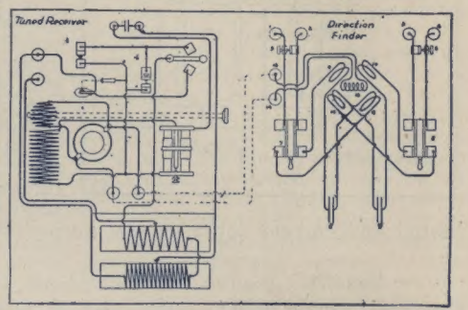


Contributed by GEORGE HAWLEY.

THE WIRELESS DIRECTION FINDER.

Wireless apparatus has been developed by the Marconi Wireless Telegraph Company, Ltd., New York City, which enables the navigating officer of a ship to take bearings of wireless-telegraph stations with a view to finding the position of his ship or to avoiding collisions with other ships says Electrical World. It is especially adapted to use when fog or other weather conditions prevent employing the usual direct-bearing method. Under reasonably good conditions bearings may be obtained within two or three degrees of the correct value, and under the worst conditions within five degrees. The error due to the instrument itself does not exceed one degree. Iron-work in the ship has practically little effect on the results obtained, and if any deviation does exist, it may be compensated for. One advantage of this apparatus is that a ship equipped therewith does not have to be swung around while bearings are being taken. The range of the installation is from about 10 miles to 50 miles or more, depending on the power of the wireless stations from which the signals are being received, and in the case of small ships, on the size of aerial which can be erected.

The operation of the apparatus is based on the principle that wireless antennas will receive Hertzian waves best when the plane of the aerial is in the direction of the station propagating the waves which are being received. If the plane of the aerial is at right angles to the direction from which the signals are coming it receives no impulses. In intermediate positions the current induced in the aerial due to the Hertzian waves varies as the cosine of the angle between the plane of the aerial loop and the direction of the sending station.



The installation necessary for wireless direction-finding consists of two parts—the aerial circuit and the detecting circuits. The aerial comprises two triangular loops of equal size similarly supported in vertical planes crossing each other at right angles. The loops are usually supported by one corner and are installed with their planes at 45 degrees with the center line of the ship.

The base-line of each loop is divided into two sections by an insulator inserted at the point where the two conductors cross. Wires connect the insulator-joined ends of the two aerials with terminals 1, 2 and 3, 4 respectively on the direction-finding instrument case. The connections inside the direction finder are shown in the accompanying diagram, where coils 9 and condenser 11 are connected in series across the gap of one aerial and coils 10 and condenser 12 are connected similarly across the gap in the other aerial. The axis of the coils connected to one aerial is at right angles to that of the coils bridged across the other aerial.

Inside the crossed coils is a third coil called the "exploring coil" mounted on a vertical spindle carrying a pointer which shows the position of this coil with respect to the fixed coils. As mentioned before, the current induced in the aerials is proportional to the cosine of the angle between the plane of the aerial loop and the direction of the sending station, therefore the current in the cross coils will correspond with these values and produce a resultant field, the direction of which can be determined by the exploring coil.

Terminals 14 and 15 are connected to wave-detecting apparatus similar to that used in receiving radio communications. By varying the position of the exploring coil and at the same time listening to the intensity of the signals in the receivers of the detecting set, it is possible to find one position of the exploring-coil pointer for which the signals will sound louder than when the pointer is in any other position.

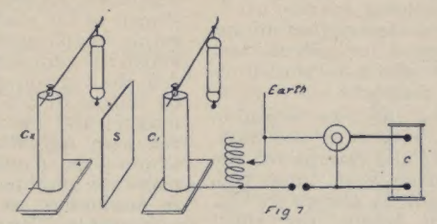
This condition will exist when the plane of the exploring coil is at right angles to that of the resultant field of the crossed coils, or in others words, when its plane is in the direction of the station from which the signals are coming.

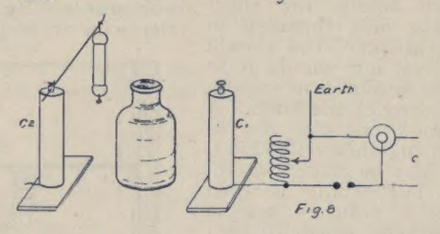
A small testing instrument is also employed in connection with the apparatus for the purpose of adjusting the instrument and of detecting any defect in the installation which might cause an error in the bearings obtained. It consists of an ordinary wireless sending set, the aerial of which is located at equal distances from the two direction-finding aerials so that the latter are equally excited thereby. If the direction-finding aerials are in every way identical, as they should be, the direction finder will indicate that the test aerial is on the center line of the ship.

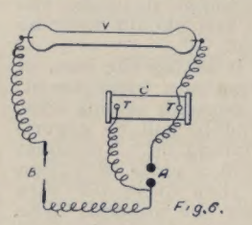
When bearings are to be taken the ship's wireless operator signals the station whose bearing is desired and asks the operator to send messages for two minutes at the wavelength to which the ships apparatus is tuned. This direction-finding apparatus will indicate the line on which a wireless transmitting station is located but will not show in which direction the station is along that line.

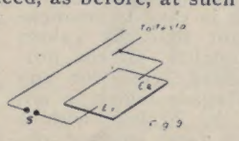
SOME EXPERIMENTS WITH HIGH-FREQUENCY CURRENTS. (Concluded.)*

Experiment 6. *Induction and Ultra-violet Light.*— It has long been known that the incidence of ultra-violet light on a spark gap is attended with remarkable effects, for, in some cases, it is able to facilitate a spark discharge, where otherwise it would not occur. This can be demonstrated in the following manner. In the circuit of a spark-coil C (Fig. 6) we have a vacuum tube V, connected up with a spark-gap B, and just opposite a short distance away is an alternative spark-gap A. This latter is provided with brass balls, while B has plain iron or zinc wire electrodes. A screen of cardboard or glass is placed between the two spark-gaps, and A is arranged so that it does just not spark, while B sparks easily. Then the vacuum tube is brightly illuminated. But if the screen be removed, the sparks at B, rich in ultra-violet light, will cause A to spark vigorously, and the vacuum tube will now hardly glow at all. Looking back, now, to our previous induction experiment we saw that if the second coil of fine wire were placed at a sufficient distance from the first, the Geissler tube failed to light up, owing to the weakness of the inductive action. But we can cause it to shine under the influence of C_1 ultra-violet light. To the first coil A, is attached a Geissler tube (Fig. 7), which is connected up to the oscillating system, and is brilliantly lighted up, when "resonance" is established. Having ascertained this, place the second coil C_2, with Geissler tube attached, at such a distance from the first that illumination fails to take place. Let a screen S be placed between them, and "earth" one terminal of the second coil. On illuminating the first tube by actuating the coil, and removing the screen, it will be found that the second Geissler tube will now light up. The passage through it of the weak induced current generated in the coil is facilitated by the ultra violet rays emitted by the first tube. The replacing of the screen will, however, cause the tube to go out at once. We may employ, however, another method. Let the two coils be placed, as before, at such a distance that the second Geissler tube just fails to light up. Then introduce between them a large insulated jar (Fig. 8) of distilled water or petroleum oil. This acts as a lens, concentrating the radiation, and the vacuum tube will now light up.

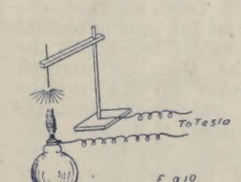




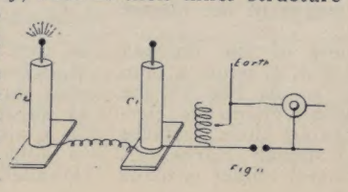




Experiment 7. *Physiological Action.*—The classic experiment of electrifying a basin of water with an induction coil, and fishing out coins from it, is well known to all of us. But is it possible also to get surprising shocks from the high-frequency current of a Tesla secondary. A basin of water is fitted with two electrodes E_1 and E_2 (Fig. 9), connected to the secondary; and there is also a spark-gap S, varying in length from ¼" upwards. If the two electrodes be bridged over with a finger and thumb, a series of smart shocks will be experienced depending on the length of the spark-gap.



Experiment 8. *Action of Flame.*—This is a very interesting experiment. It is well known that flames are able to act as conductors of electricity, both in their inner structure and also in the hot vapours and gases ascending from them. To the metal cap of an ordinary spirit lamp or to a Bunsen burner, let there be connected one of the poles of a Tesla secondary (Fig. 10). First of all the gas itself ignites, and the flame appears to be giving out electricity at its upper part. If now a pointed wire, insulated and connected to the other pole of the Tesla, be placed at a moderate distance over the flame, we get at once a very striking and characteristic display of high-tension discharge. From the upper part of the wire a beautiful brush discharge spreads out in all directions, with streamers of violet light passing between the wire and top of flame. On reducing the distance, the streamers pass gradually into a blue-violet cone of intense actinic light, rich in ultra-violet radiations. We can by its aid illuminate fluorescent screens, and cause it to play the part of a Geissler tube. We can also employ two burners connected up to different poles of the Tesla, and sparks will pass from one flame to the other, accompanied by violet discharges, thus showing the conductivity of flames.



Experiment 9. *Action of Two Coils on One Another: Oudin's Resonator.*—We make use of the two coils of fine wire C_1 and C_2, as employed in Experiment 5, on induction. Instead, however, of placing them a short distance apart unconnected as in that experiment, let us connect them by a wire joining their lower terminals (Fig. 11). We can then, by tuning the two systems and establishing resonance, as before, cause either of the two coils to emit a powerful brush discharge or to illuminate a vacuum tube at will. It is very interesting to watch the behavior of the two coils as they are each gradually brought into resonance with the main oscillatory circuit. Interesting effects are seen, too, if we wind the coil C_2, with wire of a larger diameter than that of C_1. The resonance is at once affected.

The foregoing experiments have been described somewhat briefly, but with a little patience and study on the part of the experimenter success will readily be attained.

*First part in June, 1914, issue.

DAMPED OR UNDAMPED RADIO OSCILLATIONS; WHICH?

H. Reim, in the Elek. Zeit. for July 30, 1914, discusses whether wireless telegraph stations should be operated with damped or undamped oscillations. That is, whether they should be operated by a spark system or by high-frequency machines. In favor of the spark system (damped oscillation) there is only one fact, namely, the ease with which the wave-lengths can be varied quickly and continuously over a wide range. As in most large wireless stations it is sufficient to generate one or only a few different wave-lengths, this advantage of the spark system is not decisive. With respect to the efficiency on the sending end, or the energy absorption in the ground and in the atmosphere, or the possibility of using a sound receiver, there is no essential difference between stations using damped or undamped oscillations. With respect to all other important points the comparison is in favor of undamped oscillations (high-frequency machines). With the latter, generation of the largest amounts of oscillation energy is possible without any fundamental difficulty. At the same time the transmitting antenna is utilized to the fullest extent. Moreover, the energy absorption of the receiving indicator is always greater with undamped oscillations than with damped ones. Finally, stations with high-frequency machines do not disturb adjoining installations using spark systems in their mutual intercourse.

Edw. E. Lewis, Bridgeport, Conn., writes the E. I. Co. as follows:

"I received your catalogue a few days ago. Congratulations. It is the best catalogue I have ever seen. The information and radio formulae in the back is fine, and its assortment of wireless apparatus and raw material can't be beat.

"Wishing you the greatest success, I remain yours, etc."

SPEED RECORD OF SWIFTEST MOVING THINGS ON EARTH.

Human thumb nail grows	2/1,000,000,000 of a yard per second
Bamboo tree grows	27/10,000,000 of a yard per second
Human hair grows	13/1,000,000 of a yard per second
Snail moves	15/10,000 of a yard per second
Man can walk (record)	1 mile in 6 minutes 29 1/5 seconds
Man can run (record)	1 mile in 4 minutes 15 3/5 seconds
Torpedo boats travel	35 miles in an hour
Man can skate (record)	1 mile in 2 minutes 12 3/5 seconds
Motor-boats can travel (record)	57 miles in an hour
Iceboats glide	1 mile a minute
Aeroplanes fly	100 miles an hour
Steam railroad engines go	120 miles an hour
Automobiles go	1 mile in 25.4 seconds
Sound travels	305 yards a second
Cyclone rushes	585 yards a second
Shell from a gun flies	975 yards a second
Electricity goes	327,500,000 yards a second
Light travels	328,028,800 yards a second

WIRELESS DEPARTMENT

GALENA DETECTORS.

Galena is one of the best minerals for detectors, and some amateurs don't like it, but if properly used it should give results as good as, if not better than, those obtained with any other form of crystal detector, or almost any type c. receiving instrument. ··

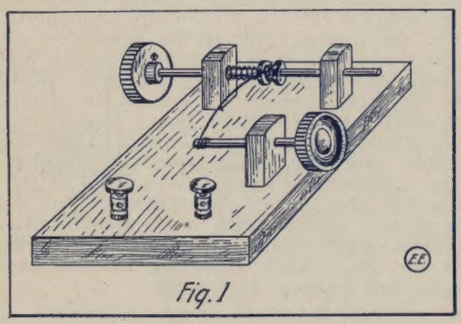


Fig. 1

It is not uncommon for experimenters to take a piece of galena and clamp it tightly between two flat surfaces, or under a sharp point, and, as the signals are in consequence inaudible, to complain of the insensitiveness of their galena. Others run a heavy battery current through it, and, although this is not as bad as many forms of treatment to which the mineral is subjected, it is sufficient to prevent it giving the best results it is capable of. If experimenters would use and adjust galena properly, they would at once realize its value as a detector mineral.

It has been found that to get the best results from galena it is necessary to use a *light* contact—the material of which this contact is made being of less

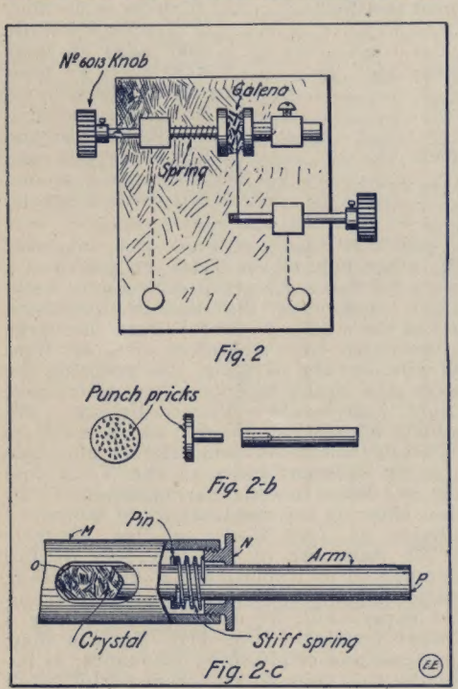


Fig. 2

Fig. 2-b

Fig. 2-c

importance than the lightness of the contact. For this purpose a short piece of 36 or 38 guage copper or phosphor bronze, gold, etc., wire should be fastened at one end, and the other allowed to rest by its own weight on the galena.

The contact points may be of various types, and a piece of graphite (not more than the point of a lead pencil) or a small piece of tungsten makes a sensitive combination. For local work a plain piece of copper wire is as good as anything; it is robust, and not easily affected by a transmitting spark.

The following is a description of an excellent detector stand for galena, and the construction of which is shown in the accompanying diagrams.

In these diagrams the two uprights are threaded and screwed to the base. Two discs, which are the clamps for the galena, are turned from ¾-in. brass rod. One disc and its stem, as shown in Fig. 2*b*, is left to turn freely, the short stem fitting into the hole threaded in the rod. The "cat-whisker" rod should not revolve too freely, nor should it fit too tightly; it should be just firm enough to turn easily by means of the knob. A spring is wound upon one disc rod so that they are forced together. The binding posts in Fig. 2, may be placed wherever convenient. The whole is then mounted either on a polished marble (E. I. Co. No. 9,500 base, worth 70 cts.) or a hard rubber base; the former may be recommended as it gives a substantial appearance to the instrument, and is cheaper than rubber. Should any trouble be experienced in fastening knobs, (which can be "Electro" No. 6,013 Type), a good method is to heat the rod, and then rub sealing-wax over it. The rod should be warm enough to make the sealing-wax liquid, and should then be forced into the knob.

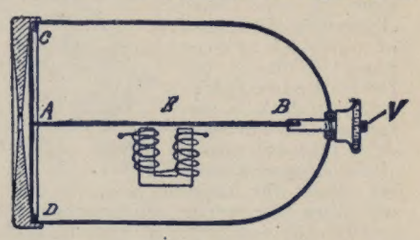
Another method is to tap the hole in the knob and thread the knob to fit, it is then screwed on with sealing-wax. In this way no trouble will be experienced from knobs falling off. To adjust the instrument clamp a piece of galena between the discs, then bring the wire over until it touches the mineral. The crystal may be turned to and fro, and even clear around, and any spot may be touched by moving the "cat-whisker" rod. In this way a good spot may be discovered.

This detector may appear awkward to adjust at first, but a little practice will soon show that it possesses many advantages, and that it is easy to manipulate. It is important that the galena should be of good quality. If the portion available has been lying for any length of time in a space which is not air-tight, it should be broken with a pair of pliers and a fresh surface obtained. The surface of the galena should never be touched with the hands or any portion of the skin, as enough natural oil will gather on the surface of the mineral to effectively insulate it against weak signals. If signals cannot be heard through the first piece of galena tried, the mineral should be broken up until either a sensitive piece is obtained or until it is too small for use. The best galena will have a "wavy" appearance and breaks up in cube shaped blocks. It is almost impossible to describe a good piece of galena, but experimenters will have no difficulty in picking this out for themselves, by testing it in their detector stand with radio signals or also by means of the buzzer test.

A perspective view of the finished detector is given at Fig. 1, while a plan view is seen at Fig. 2. At Fig. 2*b*, the details of the crystal clamp is perceived, the discs having their surfaces roughened by prick punch marks. A handy and quick mineral holder is made as seen at Fig. 2*c*, where a brass piece M, is bored out, and a hole drilled crosswise thru it at O. A stiff spiral spring as shown tends to push the Cap M, back along the arm P. A pin serves to hold the base of the spring. N is threaded into the Cap M.

RESONANCE TELEPHONE RECEIVER.

At the exposition of the French Physical Society the Camillerapp "resonance telephone receiver" was exhibited. As shown in the sketch, it consists of a vibrating diaphragm CD, the center A of which is connected with the steel wire AB, the tension of which can be adjusted by means of a screw V. The telephone magnet and its coils shown at E act on the wire AB, which transmits its vibration to the diaphragm CD. The vibrations are amplified by this method, which is analogous to that used in hot-wire voltmeters. By varying the tension of the wire it is possible to regulate the



frequency proper of the diaphragm and to produce resonance for current of a given frequency.

THE CALIBRATION OF WAVE-METERS FOR WIRELESS TELEGRAPHY.

The main source of error or uncertainty in the calculation of the frequency of a wave-meter lies in the capacity between neighboring portions of the coil forming the inductance. With the condenser removed the coil itself has a definite natural frequency, the ends acting as the plates of a condenser, and the central portion as an inductance. Knowing the effective inductance and the natural frequency, the effective or self-capacity of the coil is calculable. Prof. G. W. O. Howe, in a paper before the Physical Society, asks in what way the calculation of frequency for a capacity inductance combination must be modified in order to allow for the self-capacity effect of the coil. No attempt is made to give an exact answer to the question, but it is shown that for practical purposes it is sufficient to take the effective inductance as equal to the total inductance and add the self-capacity, calculated from the natural frequency on this assumption, to the capacity of the variable condenser. An experiment was made on the coil having an inductance of 2.16 millihenries, and a natural wavelength, when freely oscillating in space, of 185.5 m. Its terminal capacity was increased by small amounts by means of brass spheres varying distances apart, and the resonant frequency determined in each case. Plotting the square of the wave-length against the added capacity, a straight line is obtained which does not pass through the origin for zero added capacity. The result shows that the effect of self-capacity of the coil is to add a constant capacity of 5.5 micro-mfd. to that of the variable condenser.

HOW-TO-MAKE-IT DEPARTMENT

This Department will award the following monthly prizes: FIRST PRIZE $5.00; SECOND PRIZE $2.00; THIRD PRIZE $1.00. The idea of this department is to accomplish new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best ideas submitted a prize of $5.00 will be given; for the second best idea a $2.00 prize, and for the third best a prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings.

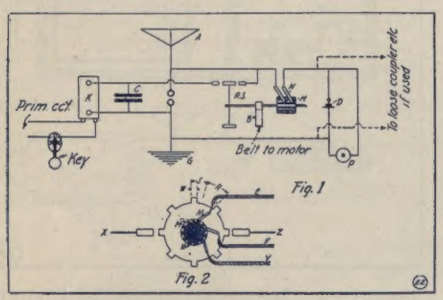
FIRST PRIZE $5.00.

A NEW WIRELESS BREAK-IN SYSTEM.

By A. J. Klaneck.

Many wireless operators have lost interest in wireless telegraphy on account of the trouble in having to wait, if they want to signal in the middle of a message until such invitation is received, and also in sending a message they lose much of the news which is being sent during that time by other stations.

Such amateur stations may easily be improved for the simultaneous sending



and receiving of messages with but a little cost. If an operator has already a rotary spark gap then the cost should hardly exceed 50 cents for additional material.

The principle of this simultaneous set consists of using the time between two successive sparks for the receiving of a message. As the time of sending may be decreased, then the time of receiving will be increased; in some cases, the time of receiving may be six to ten times that of sending, hence no synchronism is required between two stations.

If the amateur has a rotary spark gap then the only additional part he has to make is a commutator with as many commutator bars or segments as the spark gap has points on the wheel. One segment should only cover an angle nearly as the space R of Fig. 2, less the width of the brushes used for this purpose. The letter S in this figure is the time angle of sending, which is the width of spark point of the wheel "W," plus the width of the spark electrodes "X" or "Z." The commutator should be rigidly secured on the shaft of the spark gap for the benefit of an exact working of the apparatus. It is best to use a motor which has an extending shaft upon both sides, which thus permits us to attach the rotary spark wheel on one side and the commutator at the other. A good motor for this purpose will be the "Electro" Utility Motor Nos. 315 or 316, or if one already has a motor and wants to use

Fig. 1 shows this set with an ordinary hook-up, where B is the belt; R S is the rotary gap and M the commutator. A pair of brushes N complete the circuit for the receiver thru the segment of the commutator, when the sending thru the spark gap R S is interrupted.

The commutator should be made of the best material obtainable (preferably of hard rubber or fibre), and the segments should be secured thereupon with great care, such as by screws, etc. A hard rubber rod of two inches in diameter and two inches length will give satisfaction. Instead of a cylindrical commutator a flat disk type may be used with good results.

If one wants to use another hook-up which would require more connections, he can use extra pairs of brushes besides those shown in Fig. 1, as Fig. 2 shows; whereby each segment connects one pair of brushes, each at a different period than the others.

The best result will be obtained if the time of receiving is much greater than that of sending a message, which may be accomplished by decreasing the width of the spark points W, to a considerable extent, which not only increases the time of receiving, but also may increase the range of the set, because then the capacity of the set is radiating for a much shorter time and by increased power in that given time. If the operator wishes to have the same life for the spark points as before, he may increase the depth of the points correspondingly.

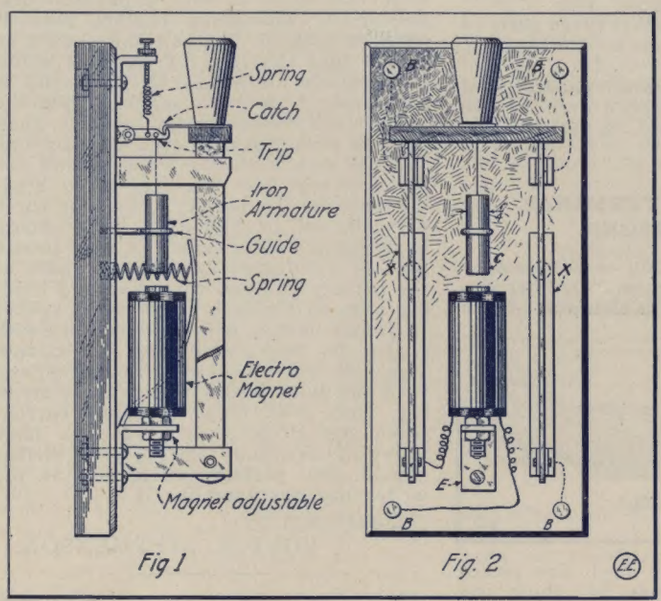
From the accompanying illustrations one will have no trouble to obtain the necessary directions for his set or another hook-up, and also the minor parts in the illustrations will be readily understood without further explanation.

SECOND PRIZE $2.00.

HOW TO IMPROVISE A CIRCUIT BREAKER.

The following article treats with the construction of an automatic circuit breaker, designed for ordinary use, to save short-circuiting of batteries or other sources of current.

It is made as follows: First, procure an ordinary double pole, single, throw knife switch. Next get an electro magnet of about two ohms resistance, (the strength of the current determining the ohmage), and mount as shown in Fig. 1 with an L-shaped bracket E.



Above the magnet place a small (1/4" dia.) round rod of soft iron for the armature. Next rest this armature in a guide made from a screw eye, and in the end of this rod solder a small piece of flexible wire. The flexible wire hooks on to the catch lever above, as shown in Fig. 1.

As the throw-out springs are the next important things, I will describe them now: They are about ¼" in diameter and good and strong. Mount them under a piece of spring brass and set in the base, as seen at Fig. 1.

Everything is now complete except for connecting up. The switch is placed in series with the circuit.

All the materials required for this breaker are obtainable from the Electro Importing Co., especially the magnet, which they make a specialty of.

The more ohmage to the magnet, the less current required to break it, and vice versa.

As the magnet is in series with the circuit it is best to have it about two ohms for ordinary work. Winding it with No. 16 B. & S. magnet wire will give good results. For very heavy current No. 14 wire may be wound on it.

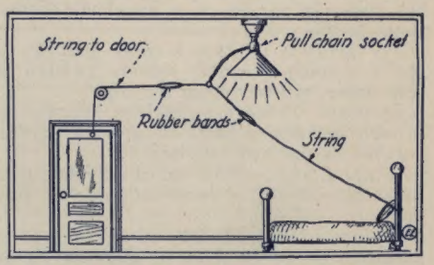
Contributed by ALBERT E. SHAW.

THIRD PRIZE $1.00.

HANDY PULL CHAIN SOCKET.

It hardly need be said that the pull chain is the handiest socket made for switching purposes. It can be used in dark halls instead of using three way switches by simply running a string along the wall and fastening to the chain at the socket.

As you will see by the diagram, I have a string on the door to turn the light on when I go in and turn it off when I go out. Of course it is best to put a rubber band in series with the string to



keep from breaking the socket when it is jerked too hard in opening the door.

Also by running a string to the sick bed the patient can turn the light on by simply pulling the string.

It can also be used on various burglar alarms very successfully.

Contributed by
C. M. CHORPENNING.

Wrinkles—Receipts—Formulas—Hints

By S. Gernsback.

Under this heading we will publish every month useful information in Mechanics, Electricity and Chemistry. This department will be edited monthly by Mr. S. Gernsback.
We shall be pleased, of course, to have our readers send us any recipes, formulas, wrinkles, new ideas, etc., useful to the experimenter, which will be duly paid for, upon publication, if acceptable.

FORMULA NO. 4.

Pyrotechny (Colored Fires.)

The Preparation of the Mixtures for Colored Lights.—The ingredients must be perfectly dry, in the state of very fine powder; mixed thoroly but very carefully together on sheets of paper with the hands or by means of cardboard spatulas.

The mixtures are best packed in capsules or tubes about one inch in diameter and from six to twelve inches long, made of stiff writing paper.

Greater regularity in burning is secured by moistening the mixtures with a little whisky and packing them firmly down in the tubes by means of a wooden cylinder, then drying.

To facilitate ignition a small quantity of the following powder, loosely twisted in thin paper, is inserted in the top:

Ignition Powder.—Sixteen parts of *mealed powder*, 2 parts of *niter*, 1 part of *sulphur*, 1 part of *charcoal*.

White Lights.—Four oz. of *salpeter*, 1 oz. of *sulphur*, 1 oz. of *black sulphide of antimony*.

Yellow Lights.—Four oz. of *chlorate of potash*, 2 oz. of *sulphide of antimony*, 1 oz. of *sulphur*, 1 oz. of *oxalate of soda*.

Green Lights.—Two oz. of *chlorate of baryta*, 3 oz. of *nitrate of baryta*, 1 oz. of *sulphur*.

Red Lights.—Twenty-five oz. of *nitrate of strontia*, 15 oz. of *chlorate of potash*, 13 oz. of *sulphur*, 4 oz. of *black sulphide of antimony*, 1 oz. of *mastic*.

Blue Lights.—Three oz. of *chlorate of potash*, 1 oz. of *sulphur*, 1 oz. of *ammonia-sulphate of copper*.

Rockets.—One part of *sulphur*, 2 parts of *charcoal*, 4 parts of *niter*, 2 parts of *meal powder*, 1 part of *steel filings*.

Silver Rain.—Two parts of steel filings, 7 parts of *meal powder*, 1 part of *niter*.

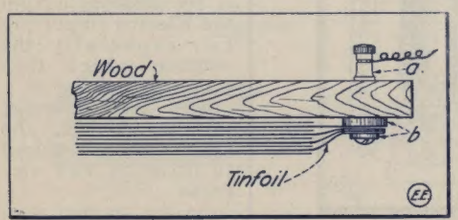
Gold Rain.—One part of *sulphur*, 2 parts of *niter*, 1 part of *charcoal*, 6 parts of *meal powder*.

Chlorate Meal Powder.—Fifteen parts of *chlorate of potash*, 3 parts of fine *charcoal*, 2 parts of *sulphur*.

Red Chinese Fire.—Sixteen parts of *meal powder*, 16 parts of *niter*, 4 parts of *sulphur*, 4 parts of *charcoal*, 14 parts of *iron borings*.

CONDENSER TERMINAL CONNECTIONS.

The troublesome and unsatisfactory job of soldering foil-sheets together can be overcome by using a clamp as shown



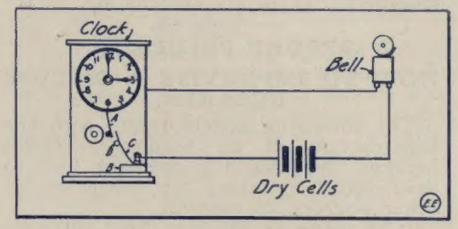
in the drawing where b, b are pieces of brass about ¼" wide, ⅛" thick and about 2" long. A, is one of the E. I. Co. No. 1,919 rubber binding post. A ⅛" hole is bored in both pieces of brass at the center of same.

Contributed by
FRANKLIN McSAVISH.

ELECTRIC BELL ATTACHMENT FOR CLOCKS.

The following will be found very convenient to anyone who has a clock of the striking type such as shown in the illustration, and desires to have the clock strike the hours in another room or building. Secure an ordinary electric door-bell or better a single stroke bell. If an ordinary door-bell is used it will be necessary to change the bell a little so as to make it hit a single stroke; this can be done in about five or ten minutes by anyone possessing a little electrical knowledge. First fasten a wire to clock frame and run this out through a small hole in back of clock case, and over to bell wherever it is placed (see Fig.).

Now secure a spring five or six inches by one fourth inch wide; also a 1920 binding post furnished by the E. I. Co. A small hole should be drilled through the spring at one end and the binding post screw put through this, and screwed into a small base 1"x2". The spring should be bent up to a vertical position or to such a position that it will clear clock striker arm A, by about half an inch. Base B, should now be secured to bottom of clock and wire attached to the binding post and run through an-



other small hole in back of clock case. A strip of tinfoil half an inch wide should be cut and wrapped around spring C several times at such a position that striker A, will make contact with it when it strikes. A small nail should be driven into the back of clock at about the position shown at D. The nail is for spring C to rest against, while the tinfoil will make better contact than just the striker spring itself would make. We will now close the clock up and run the wire which is attached to our binding post to the battery. Two or three dry cells will be sufficient. They should be connected up in series. A wire should now be connected to the other post of the battery and run to the second binding post on the bell. Now when striker A, comes back it will make contact with spring C; thus completing the circuit. The bell will now strike to correspond with the hour which the clock is striking, and will only consume current when the clock strikes. If you have followed directions closely your striker should give perfect satisfaction as the writer has one just like it.

Contributed by
BOYD Y. STEPHENSON.

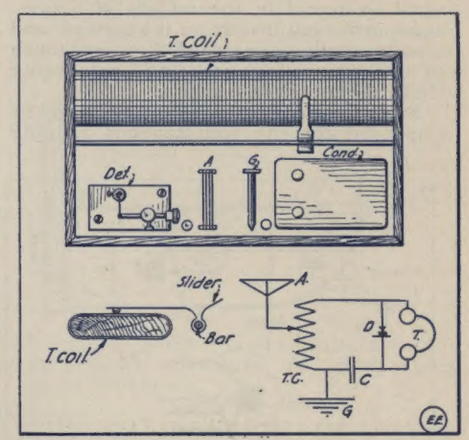
Theodore A. Hack says in a recent letter to the E. I. Co.:

"Last year I bought a wireless outfit from you and it works fine. I also bought a set of Geissler tubes and several other things and they are all 'A' No. 1."

A POCKET WIRELESS SET.

This outfit, which can be carried in a coat pocket, is very sensitive, as messages have been heard over a distance of 65 miles at night with a home-made outfit, the same as in this description.

It consists simply of a tuner, condenser, 1,000 ohm receiver, and one of the E. I. Co.'s miniature 10 cent Galena



Detectors. For an aerial a 20 foot length of bare copper wire is stretched from a tree limb down to the instruments. Merely sink a nail into the earth for the ground.

A box is made 3⅛"x2⅝"x1⅛" of ⅛" wood. Inside the cover is glued a code sheet and the box is covered outside with imitation black pebbled leather.

A condenser 1 inch square is made of five ¾" squares of tinfoil and six 1" squares of waxed paper.

The tuner is 2⅞"x1"x1½" and wound with No. 28 enameled wire.

A slider is made of copper bent to the shape shown with a drop of solder on one end.

I find this a very compact and sensitive outfit for all occasions.

Contributed by LEO E. GLEIM.

HOW TO BREAK GALENA.

To break a small piece of galena from a large piece with no waste, I have found the following method best:

Take the piece to be broken between two pair of pliers, crosswise, to the fine lines running along the surface of the galena.

Then with a sharp bend the galena will break off and with a rough surface. The rough surface, as every wireless operator knows is best, as it helps to keep its adjustment longer. Contributed by

HAROLD SANDERS.

INSPECTION OF TRANSLUCENT PRODUCTS BY MERCURY-VAPOR LIGHT.

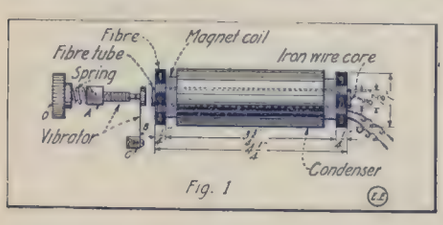
It is stated that translucent products, such as cube sugar and ivory piano keys, can be inspected and graded with much greater accuracy and speed by means of artificial light produced by mercury-vapor lamps than by ordinary daylight. Any impurities in these products stand out clearly when they are examined by looking thru them at a mercury-vapor lamp.

A Miniature High Frequency Outfit

By H. Winfield Secor

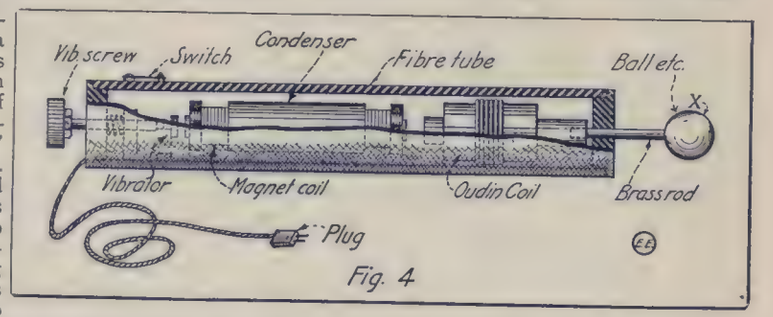
MOST High Frequency apparata is more or less bulky in its make-up, and such a set, which is complete and capable of exciting medium size X-ray tubes, as well as therapy or treatment tubes and so small that it is all contained in a fibre tube about 1¼" by 7½", is of more than passing interest to us. This description covers such a set, which is adapted to operate on 110 volt A. C., 40 to 120 cycles or direct current, universally. The general arrangement is seen at Fig. 5. The set comprises a vibrator of extra sturdy type, with its magnet coil, seen at Fig. 1, in detail; an Oudin high frequency coil illustrated at Figs. 2 and 3, and a condenser with mica dielectric, which is wrapped around the vibrator coil, as seen at Fig. 1. The assembly is shown at Fig. 4.

Referring to the details, the vibrator is indicated at Fig. 1, and the magnet coil is made up of a fibre or cardboard tube ⅜" in diameter by 4¼" long, surmounted by two cheek pieces of round fibre about one inch in diameter. On this form is wound about 5 oz. of No. 31 B. & S. enameled magnet wires to have a resistance of 118 ohms; paraffined paper is wound on between every layer of wire to improve the insulation. The layers of wire are kept about ⅛" shorter or both sides than the waxed paper. The

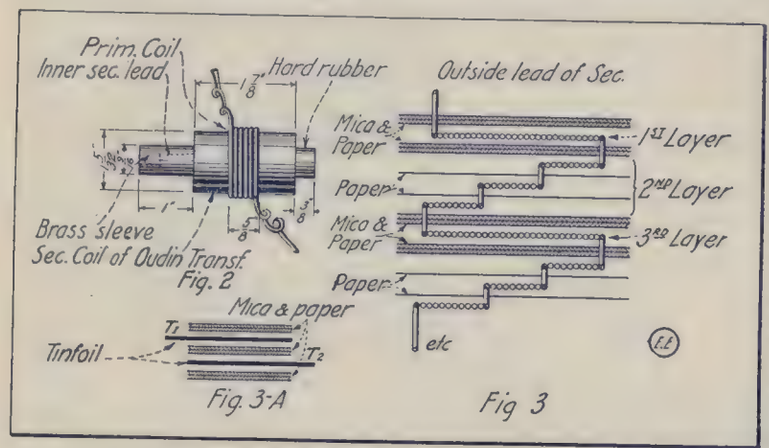


vibrator is of sturdy construction and the armature spring is very well made of a piece of clock spring, about 5/16" wide by 1/64" thick and ¾" long over all, a soft iron hammer is riveted on one end, whose size is 1/16" thick by ⅜" diameter. The contacts on the end of the adjusting screw and on the spring are made of silver, about ⅛" or 5/32" in diameter and ⅛" or more long.

The condenser indicated by C, at Fig. 5, is to be made of extra high insulation to stand the terrific induced break wave of E. M. F. when the vibrator spring breaks the 110 volt circuit thru the magnet, and this induced wave is probably of the order of 1,200 to 1,500 volts. The condenser is made up of three dielectric leaves, as seen at Fig. 3 A; each dielectric leaf being composed of thin mica sheets (about .001" thick) overlapped in a continuous manner on lengths of paraffined paper, about .001" to .0015" thick. The mica and paper leaf thus made up should measure 5 feet long by 3⅛ inches wide. The two tinfoil leaves (any thickness) interleaved between the three mica and paper leaves, are cut a little shorter than the paper dielectric and 2⅝" wide.

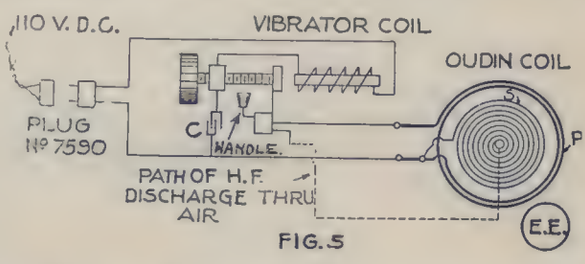


The two terminals of the condenser tinfoil leaves T 1 and T 2 are connected, as seen at Fig. 5. Also in this figure, the path of the high frequency discharge if a return circuit is provided for it, is as indicated from the inner terminal of the Oudin coil secondary to one side of the vibrator. This is not used with this set now being described, and the powerful brush discharge emanating from the ball terminal, seen at Fig. 4, which connects with the inner terminal of the Oudin transformer, is depended upon to fully excite treatment tubes or X-ray tubes connected to it. The cathode negative electrode of the X-ray bulb is connected only to the Oudin Coil Terminal X.



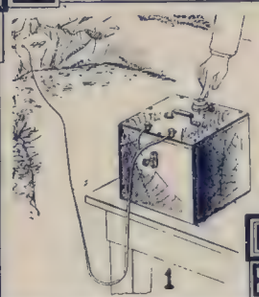
We now come to one of the most difficult parts of the apparatus, as far as insulation is concerned. This is the Oudin Transformer. Simply stated, this coil is built up on a hard rubber rod, as indicated by Fig. 2, and a layer of parrafined paper is placed between every partial layer, as per Fig. 3, and on either side, i. e., under and above every complete layer, a layer of thin (1 mil.), mica and paper is placed. This ingenious principle of subdividing the layers of wire is to increase the dielectric or insulation value which may have to stand 50,000 volts break-down strain, and 23 layers of wire are wound on the Oudin secondary, considering the complete layers, as per Fig. 3, and counting three partial layers, as indicated, as one layer also. This coil proper is ⅝" wide for the wire itself and the waxed paper and mica used is made much wider, or 1⅞" about. A layer of paper only is placed between the partial layers, which are approximately 1/3 the length of the full layer, and progress onward toward the end in every case, as shown. This process repeats itself thruout the secondary; viz., first comes a full layer, then three sections of a layer, individually insulated in the manner described; then a full layer, etc., et cetera.

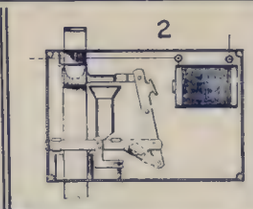
When the Oudin secondary has been completed, it is covered with three to four layers of one mil mica and the Oudin primary coil is wound on, directly in line with the secondary coil proper, and this consists of eighteen turns of No. 22 enameled magnet wire, wound on closely. The connections of these two Oudin windings are to be made quite carefully, and both coils should be wound in the same direction, as Fig. 5 plainly shows, and one end of the secondary connects to one end of the primary; P being the primary winding and S the secondary. This is, of course, an extremely small apparatus and the insulation must be kept at a high standard thruout, or the coils will break down. When the Oudin coil, etc., is placed in a fibre tube, as Fig. 4 shows, these parts are best impregnated by pouring in around them hot bee's wax, or paraffine wax. Sulphur may be used but is not recommended. This is the principle upon which some modern and larger high frequency machines are built giving as great as two foot spark lengths and more. A large field is opened up here to the experimenter, and this principle is used in making up also radio transmitting sets, and in these the secondary coil of the step-up transformer is not connected metallically with the primary coil at all, but left separate, and it then connects with the usual Leyden jars spark gap, helix, etc. Such radio sets are adaptable for A. C. or D. C. universally, of course, and up to 1 K.W. these sets prove very handy and quite efficient, besides allowing 500 cycle notes to be produced from D. C.

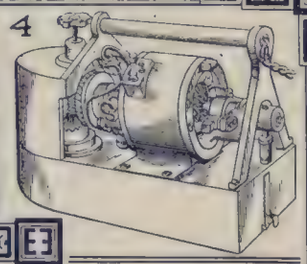


We want to buy May, '13, Oct.,'13, and Jan. '14 copies "E. E." Address the Editor.

LATEST PATENTS







ELECTRIC BLASTING MACHINE (Fig. 1)—An electrical self-inductance coil, with a push button and battery arranged to fuse a fine wire and ignite powder charge.

MAGNET DOOR LOCK (Fig. 2)—Simple devised lock controlled by electro-magnet attracting a movable armature attached to the lock mechanism.

ELECTRIC HEATER (Fig. 3)—An electric heater having an outer radiating pipe, a plurality of sections of linings of electrically insulating and heat transmitting material arranged in pipe.

MEAT-BLOCK CLEANER (Fig. 4)—A handy and compact motor-driven meat-block cleaner, having a fluted rotating tool for the purpose arranged under the base.

ELECTRICAL ORE REDUCER (Fig. 5)—Means of reducing metallic ore in an electrolyte by a reverse electroplating action.

SELF-LUBRICATING TROLLEY WHEEL (Fig. 6)—The wheel has air-tight oil chambers and small feed holes leading thru to the journal; thus ensuring positive oiling of the bearing.

LAMP SOCKET RHEOSTAT (Fig. 7)—A small resistance placed inside a socket for dimming the lamp; controlled by the key.

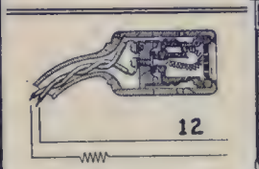
THREE-PHASE RADIO TRANSMITTER (Fig. 8)—System for utilizing and properly discharging a 3 phase A. C. for wireless transmitting station. A synchronous rotary spark gap, helps to solve the problem.

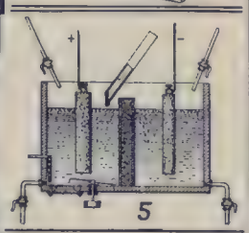
ELECTRIC RAT TRAP (Fig. 9)—A novel electric rat destroyer, which manages to electrocute the rodent by applying plus and negative current to the fore and hind legs simultaneously; afterward dropping the rat in a repository below.

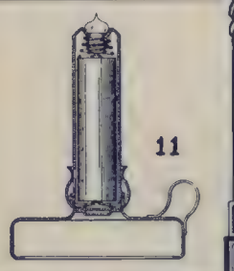
FAN DIFFUSER (Fig. 10)—An ingenious air diffusing attachment for electric fans; a secondary fan of peculiar shape being mounted so as to be rotated by the air blast and it then changes the air diffusion.

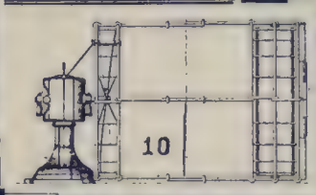
AN ELECTRIC CANDLE (Fig. 11)—Neat Candle-stick fitted with a miniature electric lamp and battery.

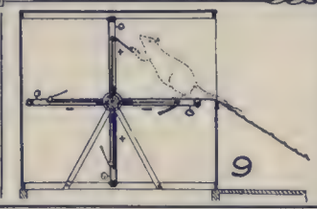
CIGAR LIGHTER (Fig. 12)—Electrical cigar lighter comprising a heating unit of fine wire, behind a perforated plate and the heated air is thus drawn forward thru the plates; air inlet holes being provided of course.

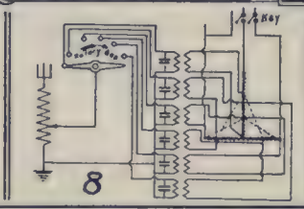


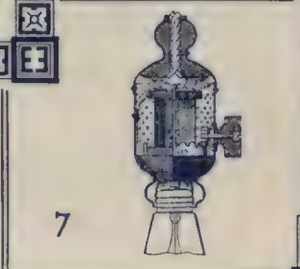






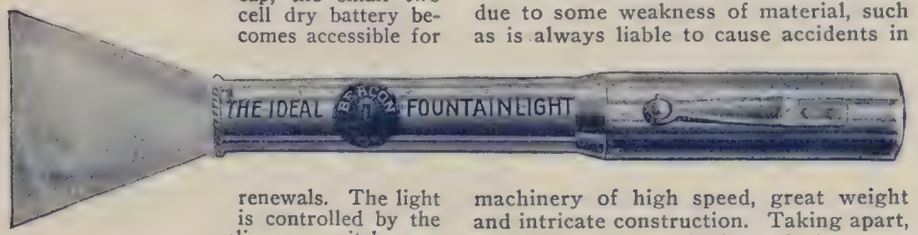






A REAL VEST-POCKET FLASH LIGHT.

A flash light just brought out embodies many desirable features, and among others, the very potent one of size. This model is contained in a neat case, which resembles a fountain pen, and in fact, it is called the *"Fountainlight."* A 2½ volt tungsten lamp is fitted in one end of the tubular chamber, and by removing the cap, the small two cell dry battery becomes accessible for renewals. The light is controlled by the clip-cap switch on the side of the cap. Due to the high efficiency of the tungsten lamp used in the *"Fountainlight"* which produces rather more than one candle power per watt of energy used, the battery will last from two to three months with ordinary use. It is supplied by the Electro Importing Company at $1.00, complete.



Wireless telegraphy links a big sugar company's numerous mills scattered thru the Fiji Islands.

TUCKERTON WIRELESS GENERATOR CAN'T BE REPAIRED IN UNITED STATES.

Secretary Daniels has made public the report of the Court of Inquiry which investigated the accident to the wireless plant at Tuckerton, N. J. The report exonerates every one connected with the plant, including the naval officials.

The court found that the accident was due to some weakness of material, such as is always liable to cause accidents in machinery of high speed, great weight and intricate construction. Taking apart, rebuilding and rewinding of the rotor and stator, including supplying new special material, which is the only practical way of making full repairs will necessitate returning the disabled machine to its builders in Germany. The court recommends that steps be taken immediately to install temporarily whatever suitable apparatus the navy department may have available or which it may be able to obtain. (*A 60 K.W. Poulson Arc Generator is being installed.—Ed.*)

THE POTATO DETECTOR.

Father Alfani, director of the Florence observatory at Florence, Italy, believes that the invention of the priest, Domenico Argentieri, of a system to receive wireless messages without the use of poles or batteries is scientifically sound.

He related that after the declaration of war the Italian government forced all private wireless stations, including that of the Florence observatory, to discontinue. The next day Father Alfani obtained from Argentieri copies of official wireless messages which the priest had been able to intercept without a wireless installation.

There were many ways to do this Father Alfani explained. One of the most simple was the very elemental expedient of sticking two steel needles into a potato. It is presumed a telephone receiver was also employed, unless the "eye" registered the message visually.

Victor Cornou C., of San Rosendo, Chile, S. A., says of "Electro" apparatus: "My little 'Interstate' wireless receiving outfit is working very well. Although my aerial is at present only 60 feet long and about 50 feet above the ground I have caught signals sent from 60 miles or more. I intend to erect a big aerial about 250 feet long, so as to be able to get some of the stations along the coast."

AMONG THE AMATEURS

AMATEUR RADIO STATION CONTEST.

Monthly Prize, $3.00.

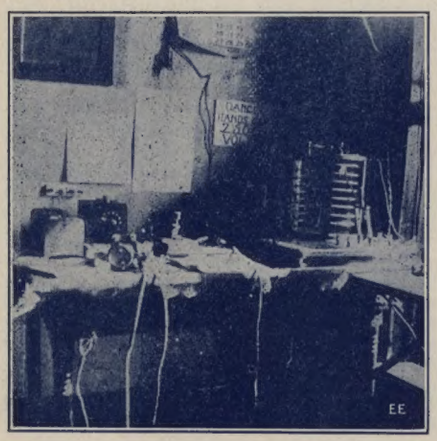
This month's prize winner.

HARRY McCARTHY'S RADIO STATION.

Enclosed you will find a photograph of my wireless set which I have been working on for some time.

The receiving set consists of a loading coil, twelve inches long and wound with No. 30 silk-covered wire, loose coupler of large capacity, two detectors, silicon and electrolytic. The electrolytic detector is made of E. I. Co. material; potentiometer, cylinder condenser, buzzer test and 1,000 ohm receivers.

The sending set consists of a high voltage transformer running on 110 volt



A.C., giving a secondary voltage of 25,000; Leyden jars of E. I. Co. material; E. I. Co. helix; spark gap, with cooling vanes. Aerial 115 feet long, four wires over two feet apart and sixty feet high at one end, and about forty feet other end.

My maximum receiving range is about 2,000 miles. I receive the time twice a day from N. A. A. Can hear Sayville, L. I., almost every night and many other stations.

I have been a subscriber of *The Electrical Experimenter* for some time, and think it one of the best electrical magazines I ever read.

HARRY McCARTHY,
816 Mifflin Street,
Huntingdon, Pa.

NEW YORK ELECTRICAL SHOW

(Continued from page 114).

demonstrations of gun firing and steering by electricity, and also radio telegraphy. The radio exhibit included a transmitting set of latest pattern and a receiving set employing a De Forest amplifier, for strengthening the received signals. An aerial was erected and led in thru a window. Visitors were allowed to hear the wireless dots and dashes hurtling thru space from the various radio stations around New York and vicinity.

All kinds of electrical appliances and devices were shown and demonstrated. An auto track was laid out on the third floor and electrically driven business and pleasure vehicles were operated around this track.

THE CARROLLTON WIRELESS CLUB.

There is a new club just founded in Carrollton, Ill. Six fourteen-year-olds compose the membership, and they call the organization the Carrollton Wireless Club, but anybody can join who is interested in wireless telegraphy. The club was formed at Harry Wright's station recently.

The president of the club is Stuart W. Pierson, and the secretary is Harry Wright. These two members have wireless stations of their own, and they can transmit messages to each other in the continental code. The other boys, who are David Roberts, Thomas Carmody, Edward Lang and Ward Dickson, are going to construct stations soon.

Stuart Pierson holds the town record for the distance from which a message has been received. He has received messages from the United States Government station at Arlington, Va., a distance of seven hundred miles. Every day he gets the time from the Illinois watch factory at Springfield for J. W. Strain.

The object of the club is to know more about wireless, and to teach members to be first class operators.

A PLEASED WIRELESS PATRON.

Minneapolis, Minn., 10/23/14.

The Electro Importing Co.,
New York City.

Dear Sirs:

Thanking you for the catalog and miniature detector which you sent me I want to tell you also of the inspiration given to me by your wonderful reproduction of a "Galena Detector" at 10 cents. I am now bound to have a complete modern wireless set. I only hope this detector in miniature has inspired many amateurs, like myself, and that it will inspire many more boys to the ambition of having a wireless set, as it did me.

I also want to recall many good points in your catalog which, as I read same, I noticed. These points I find do not exist in other catalogs, as on page 7, "Wireless and the Layman."

Let the amateur read this over and see for himself why yours is the famous *"E. I. Co." Square Deal.* I remain,

Yours truly, etc.,
(Signed.) LE ROY JENSEN.

SWAMPSCOTT, MASS. AMATEUR IMPROVES STATION.

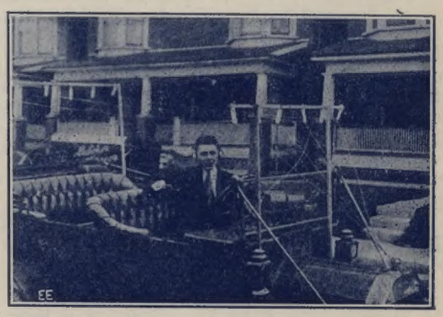
Lyman R. Stanley is making extensive improvements to his wireless station, which he maintains at his home. All of the aerials and arms are being painted and put in first class condition under the direction of George H. Lampard, and more wires to increase the power of the station are being installed. When the improvements are completed the station will probably be the best equipped amateur wireless station in this vicinity. Mr. Stanley also maintains a wireless station at his place of business on Loring avenue, Salem, which, altho smaller than the one at his home, is finely equipped.

A WIRELESS OUTFIT ON AN AUTOMOBILE.

By Frank C. Perkins.

A unique wireless outfit for an automobile as recently designed at Toronto, Ontario, Canada, may be noted in the accompanying illustration. In connection with this installation of Kenneth A. McIntyre for radio communication from automobiles a one kilowatt station was used at his house and he was able to keep in touch with the station on the car thruout the country in a radius between five and ten miles, depending upon the quality of the ground connection.

It is stated that the results, as a whole, were good and the amateurs in Toronto and the government stations at Toronto and Midland were easily heard. However, using the wires as an aerial and the car itself as a grounding condenser



A radio outfit installed on a touring car.

or counterpoise, did not give good results. The home station could only be heard about 100 yards away, but in case of communication from one automobile to another this difficulty would be overcome, as the two sets would be more nearly in tune with one another.

The portable set consisted of only the fundamental wireless instruments, receiving, Blitzen, loose coupler galena, detector, condenser and phones. The sending set included twelve inch spark coil, key twelve dry cells, six and six in series —multiple, stationary spark gap and switch.

It is of interest to note that tests were taken first every two miles and then every mile, as the operator went north from the city. However, on account of the variable factor in the quality of the ground the results were of very little scientific value, altho it was thoroughly demonstrated that wireless communication from automobiles is practical and would be of great value in military service.

H. E. BURNS A RADIO ENTHUSIAST.

H. E. Burns, of Winchester avenue, Martinsburg, W. Va., is having splendid success with his new wireless station. Recently he conceived the idea of engaging in the wireless game and erected a station, and he is now able to pick up messages as far south as St. Augustine.

WIRELESS STATION CONTEST

Our **Wireless Station Contest** is open to all readers, and a monthly prize of $3.00 is offered for the best description and photo of a wireless or electrical laboratory. Be brief and send us dark toned prints in preference to light toned ones and also a small photo of yourself. Write your description on separate sheet of paper. Typewritten copy preferred.

QUESTION BOX

This department is for the sole benefit of the electrical experimenter. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. At least one of the questions must deal with "E. I. Co." apparatus or instruments, or "E. I. Co." merchandise.
2. Only three questions can be submitted to be answered.
3. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
4. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this Department cannot be answered by mail.

DIRECTIVE EFFECT OF "L" AERIALS.

(182.) Mr. W. R. Cottrell, of Prairie City, Iowa, writes us: "I understand that the 'L' type aerial tends to act strongest in the direction toward which its free end points; is this correct?"

A. 1. We believe you are somewhat mistaken in assuming that the direction of maximum efficiency for the inverted "L" type aerial is in the direction toward which its free end points, and, in so far as we are aware, this action is directly opposite to your statement, and the maximum efficiency and activity is in the direction opposite to that in which its free end points. For this matter, we would refer you to the standard work on the subject "Electric Wave Telegraphy," by Dr. J. A. Fleming, and also to several other authentic works on wireless matters, such as Prof. G. W. Pierce's book, entitled "Principles of Wireless Telegraphy." Also in regard to spark gaps, we do not believe the compressed air spark gap to be superior to the quenched gap.

RADIATION CURRENT IN RADIO ANTENNAE.

(183.) Mr. Whitcomb Moore, of Terre Haute, Ind., asks us: "How is it possible for a ¼ K.W. radio transmitter to radiate several amperes when its transformer secondary only produces a very small fraction of an ampere?"

A. 1. Answering your communication relative to the matter of obtaining a relatively high current radiation on a small wireless set, where the actual current in amperes delivered by the transformer secondary is but a small fraction of an ampere; would say, that of course in a wireless or high frequency set operating on this principle, the current in amperes is measured in the high frequency circuits (which connects the aerial circuits of a wireless station of course), and the current mentioned is the *apparent* current which is not in phase with the E.M.F. or voltage of the circuit; or in other words, the power factor is much less than unity, the current leading the E.M.F.

The Electro Importing Company station, as a matter of fact, has radiated about 1½ amperes from a ½ K.W. open air gap transmitter, even tho it was roughly tuned up in their radio laboratory, at New York; in other words, the *power factor* was much less than unity.

Back numbers of *The Electrical Experimenter* are furnished at five cents per copy, from July, 1913, to date, except the October, 1913, number, and January, 1914, issue, which are out of print.

DRIVING SMALL DYNAMOS.

(184). Mr. E. Dwehus, of Rockville, Neb., asks: "Can I drive a type S. S. *"Electro"* dynamo by another similar machine for a motor, efficiently?"

A. 1. In reply to your query would say that it is not at all practical to drive a type "S.S." dynamo with another similar machine, as there is always a considerable electrical and mechanical loss in such an arrangement, and in consequence; it is impossible for a dynamo so driven to deliver its full rated output and a somewhat larger machine than the dynamo has always to be used, to drive same at full output.

Of course on a larger size dynamo, such as 5 to 10 H.P., the over-rating required on the prime mover or driver only amounts to a small per cent, say 5 to 10%; but on these small machines, such as the type "S.S." the relative transformation losses are very much higher, and the loss above mentioned with such an arrangement as you outline will probably amount to 40 or 50%, if not more; so that a motor about twice as powerful as the generator should actually be used under these conditions, such as a No. 810 type machine.

You would do very well, we believe to install a small size ¼ H.P. gasoline engine, with a No. 810, 8 volt, 10 ampere, *"Electro"* generator, as listed in their catalogue No. 14.

RADIO RECEIVING SET WON'T RESPOND.

(185). Mr. Harry L. Dearborn, of Lincoln, N. H., writes us at length with photos complaining about his radio receiving set not operating at all, even tho particularly well built and wired up.

A. 1. We must confess that it is not very pleasant to have such poor results as you mention from a large wireless receiving set constructed as shown in your photographs, etc., but we believe that you can get this outfit working alright by the aid of the following suggestions.

Regarding your set in detail, would say that your wiring diagram appears to be alright and if you are not using the *buzzer test*, you should of course do so, in order to properly adjust the detectors to their greatest sensitivity. It sometimes occurs that the fixed condensers or also the variable condensers may become short-circuited, and they should be tested for this trouble by means of a buzzer and battery. For the large fixed condenser in series with the detector circuit, you will do best to employ a No. 10,000 E. I. Co. type, but the Jr. Fixed condenser No. 10,010 has been used by the Editor in the laboratory, with very good results, for ordinary work.

Regarding your aerial, which of course is quite important, would say that you appear to have this arranged quite efficiently in that, as you state, it is situated at approximately right angles to the nearby high tension transmission lines. Secondly, in regard to your aerial, we would suggest that you employ 2 to 4 strands spaced 4 to 5 feet apart or more with a considerable length in the flat-top section; giving this main section between spreaders a length of, say 200 to 300 feet, and we are sure that this will bring you results; and also of course the higher you can get the aerial, the better. We do not advise extra long lead-ins, but do not believe that this will become necessary in your case. You might try a looped aerial. We know from experience as well as from that of a great many of our readers, that a long aerial will give good results for receiving; and some of our amateur friends have used a 2 to 4 strand aerial as long as 300 to 400 feet with great success, and some of them have even used a single strand with a length as just mentioned very successfully.

Direct current lighting service in houses does not ordinarily have any effect on radio receiving sets.

In closing we may repeat again that all of the circuits had best be carefully tested with a buzzer and battery, etc., for short-circuited condensers or open-circuited tuning inductances, as the Editor has often found that such defects can be present, and the usual *buzzer test* for the detector will not make these defects known; owing to the peculiar way in which it acts on the detector, viz., due to a powerful *kick current* of several hundred volts potential utilized from the buzzer make and break induction.

KICK-BACK PREVENTION.

(186.) Delbert Myers, of Amboy, Ind., writes us:

Q. 1. Do I have to use a kick-back preventer with an E. I. Co. No. 8,050 transformer coil on 110 volt current?

A. 1. Replying to your question will say that the No. 8,050 coil can, of course, be operated on regular lighting circuits, and in such cases one of the *"Electro"* kick-back preventers should of course be used in series across the primary of the transformer and also their centre connection connected to ground. Two ½ M.F. telephone condensers may be used for protection purposes, but it is best to employ the special E. I. Co. kick-back preventer in which the condensers are especially insulated and designed for this work.

By using a choke coil in series with the electrolytic interrupter on the 110 volt circuit, the flickering of the lights will be obviated.

REPAIRING GEISSLER TUBES.

(187.) Roy W. Marshall, of Loxley, Ala., asks if he can fix up a Geissler tube cap which has become loosened?

A. 1. We would suggest that it will be all right to carefully glue or otherwise stick back the terminal on your geissler tube or plaster of paris may be used. The glass teat you mention, is left on the tube to seal off same with, when a vacuum has been produced.

MERCURY ARC RECTIFIERS.

(188.) The L. A. School of Lincoln, Neb., desire prices on mercury arc rectifiers for charging storage cells from A. C. with.

A. 1. We quote below E. I. Co. prices on this apparatus: $112 net on a 110 volt, 60 cycle A.C. to D.C. Mercury Arc Rectifier, to deliver 10 amperes D.C., and suitable for recharging 3 to 10 lead storage cells. This price is for the complete outfit including mercury bulb, auto transformers, etc.

On a similar Mercury Arc Rectifier, with a capacity of 5 amperes D.C. and suitable for recharging 1 to 7 lead storage cells, the price will be $84.50, net.

FLASHLIGHT BATTERIES.

(189.) Herbert Forstrom, of Warren, Ore., asks several queries:

A. 1. Replying to your letter of re-

cent date, would say that the breaking strain of the E. I. Co. No. 9,461 and No. 10,007 insulators is several hundred pounds.

In regard to small flashlight batteries, such as they supply, would say that these are composed of from 2 to 3 individual and distinct cells of battery, and each of the cells can work independently of the other course; and also the voltage of each cell is that given by dividing the total voltage of the battery by the number of cells connected in series; thus each cell in a 3 volt battery would supply 1½ volts, and in a 4½ volt battery each cell would also supply 1½ volts; and in fact all battery cells of this type and character give about 1½ volts each.

SWITCH-BOARD SUPPLIES.

(190.) O. R. T., of Valparaiso, Ind., wants prices on switch-board parts:

A. 1. We are pleased to give you E. I. Co. prices as follows: They can supply a 600 volt, 125 ampere, double pole, single throw, knife switch at $4.50, net, and can supply switch-board slate (plain), at $1.25 per square foot.

ELECTRO-MEDICAL BOOKS.

(191.) John G. Dorcy, of Anarcortes, Wash., writes us for information on simple electro-medical books:

A. 1. Answering your communication of recent date we take pleasure in recommending Dr. Frederick Strong's books on Electro-Therapeutics and his advanced book covering X-rays, etc., and the various modalities for the application of high frequency currents to the body, et cetera, is given completely in the $3.25 work, and a similar but smaller hand book covering electric cautery, etc., is worth $1.25. These prices are for the books prepaid, They are very easily understood and entirely free from technical terms. They are supplied by the Electro Importing Company.

RADIO ANTENNA WAVE LENGTHS.

(192.) Donald B. Rockland, of Wellsboro, Pa., writes:

Q. 1. What has the factor four to do with the wave length of a certain antenna?

A. 1. We cannot here go into the theoretical discussion of just why or rather what the factor four has to do with the wave length of a radio aerial and its exact length proper; but suffice it to say, this factor is generally nearer 4.5 than it is 4, as far as it is the Question Dept. Editor's actual experience in measuring aerial wave lengths with a wave meter in the laboratory. In closing, we may say that the wave length of a certain aerial is equal to about 4.5 times its actual length and height in meters; one meter being equivalent to 3.28 feet; and also the wave length of a simple tuning coil is equivalent to roughly, four times the actual length of the wire on the coil. You will find this matter partially discussed in the E. I. Co. new catalog No. 14, in the appendix at the back of same.

Q. 2. Why can I not receive radio signals from a distant station when my set is first class in every respect?

A. 2. We have looked over your diagrams and believe you are not using a fixed or blocking condenser and this of course should always be used, preferably across the telephone receivers, for the longest distance work.

WARPED STATIC MACHINE PLATES.

(193.) Charles S. Lirely, of Blocker, Ark., desires a price on new *"Electro"* static machine plates, and also how to straighten warped plates.

A. 1. We beg to advise that new plates for the No. 9,000 static machine complete, with tin-foil sectors, are worth $1.00 each, net. We give you herewith directions for straightening warped plates:

Directions for Straightening Warped Plates.

Unscrew the vertical uprights of the machine to take off the plates. Screw the hubs off these plates so no parts are on the plates, except the tin-foil sectors. Now heat a few pieces of heavy cardboard on a stove so they become quite warm, but not hot enough to hurt your hands. Place one of the plates between two of the heated cardboards, and place a number of heavy books on top and let the plates cool. After this they will be straight as ever and can be placed back in the machine.

HAROLD DECKER PASSES GOVERNMENT RADIO INSPECTION.

Harold Decker, although only 16 and very small in stature, is both bright and ambitious.

He has a wireless telegraphy outfit in his home, 323 Church street, Poughkeepsie, N. Y. The apparatus includes a tower on the barn roof. He can hear messages flying thru the air in all directions, some of them originating hundred of miles away.

His grandfather took him to New York recently, and while there Harold tried the Government examination for wireless telegraphy operators.

He had no great idea of ever being appointed to the Government service, owing to his physical limitations, but he tried the test anyway. Now he has been informed that he passed, and that his percentage is quite high.

Christian E. Arthurs, of New Rochelle, N. Y.:

"I am a constant reader of the Electrical Experimenter and could never be without it. I will shortly send you 50 cents for a year's subscription."

¼ K. W. PACKARD TRANSFORMER SENDS 150 MILES.

William Rocheleau, of Westbrook, Me., recently has been able to transmit messages to Northampton, Mass., a distance of 150 miles, with his ¼ kw. Packard transformer. His aerial is only fifty-five feet high and the transmitting wave length but 200 meters, in compliance with the wireless law. As a further commendable feature of this long-distance transmission, it may be added that this distance has been covered when using the lowest power possible on the transformer, i. e., the fourth step of the primary coil was cut in.

A COMPLETE GALENA DETECTOR FREE

Here is what we give you—Solid black fibre base 1⅛"x1¼". A piece of sensitive Galena mounted in the nickel detector cup. This cup is also a binding post and the connecting wire is fastened by means of set screw. Sliding nickel rod is embedded in solid hard rubber handle ⅜" in diameter. At the other end of the rod is fastened the phosphor bronze "Cat-Whisker" wire. The sliding rod slides in the nickel spring standard, which also forms a binding post at the same time.

No matter if you have a dozen detectors, you will want this one. It is the neatest little instrument you ever saw **and it works as well as a $10.00 one.**

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Shipping weight 1 lb.——Cat. Price $1.00, Now 75c.

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No. 1881 Motor. Similar in construction as above No. 1880 Motor, except that it is not incased and a little lighter. Size 3¾ x 3¾ x 1¾".

Shipping weight 1 lb.——Cat. Price $1.25, Now 75c.

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No. S. 115 Banjo. 22" in size. Made of hardwood, metal trimmed, calf skin head with instruction book and key.....	1.08	.80
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No. S. 117 Guitar. 33" long. Finest hardwood, inlaid fingerboard, really a beautiful instrument.....	1.55	1.20
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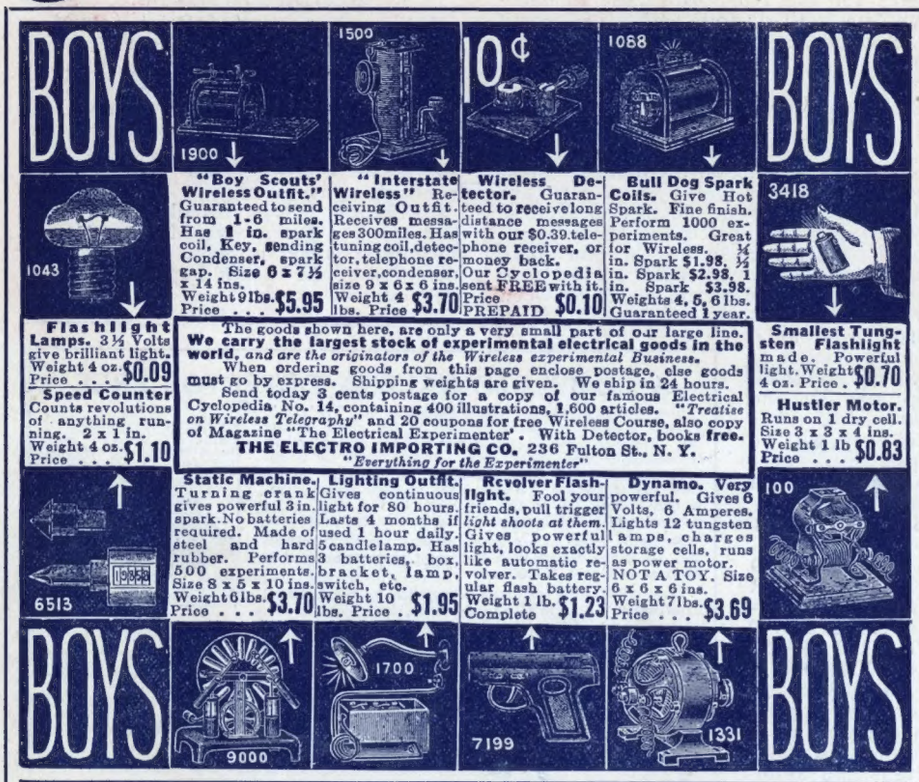
THE E. I. CO. NEWS



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The Outfit has been brought out by us not with any idea to make a large amount of money on its sale, but merely to advertise our business, as we feel that anyone who gets this outfit will become so enthusiastic about wireless that in time, will want our high grade instruments. This explains our extremely low price. Don't judge by price, the outfit is not by any means a flimsy one, as all the materials going into it are the best that money can buy, and each outfit is guaranteed by us to receive wireless messages within a radius of from 50 to 200 miles, and if other apparatus be bought from us for use in conjunction with this outfit, it will do as good work as a very expensive "Wireless" set.

The outfit comprises the following:

One Galena Detector, size 2 in. x 1½ in. x 1¼ in.

One 75 ohm Pony Telephone receiver with 2 feet green cord.

Sufficient copper wire to make a 4 wire aerial 40 ft. long.

Sufficient insulated wire to make all connections.

10 Insulators for the Aerial.

Ground Clamp.

A set of Morse, Navy and Continental codes.

Directions.

The entire outfit is boxed in a handsome cardboard box, size 7 in. x 6¼ in. x 1½ in. and we guarantee safe delivery to you. The shipping weight is 3 lbs., and if the outfit is sent by parcel post, add additional postage.

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